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Your JEE Guide

ISC Class XII · Biology Paper 1 (Theory)

Sample Question Paper 6 · Session 2026-27

Time allowed: 3 hours (plus 15 minutes reading time) **Maximum marks: 70**

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This is an original practice paper written to the CISCE 2027 specimen paper format; it is not issued by CISCE.

General instructions:

1. You are allowed an additional fifteen minutes for only reading the question paper. You must NOT start writing during the reading time.
2. The paper has eighteen questions in all. Answer all questions.
3. There are four sections: A, B, C and D. Internal choices have been provided in two questions each in Sections B, C and D.
4. Section A consists of one question with twenty subparts of one mark each.
5. While answering Multiple Choice Questions in Section A, you are required to write only one option as the answer.
6. Section B consists of seven questions of two marks each. Section C consists of seven questions of three marks each. Section D consists of three questions of five marks each.
7. Diagrams should be drawn wherever necessary, using a pencil only.
8. The intended marks for questions are given in brackets [ ].

Section A (20 marks)

1.	**(i)** A bacterium whose DNA is fully labelled with ^{15}N is grown in a ^{14}N medium for two generations. The fraction of DNA molecules that are hybrid ($^{15}N/^{14}N$) is: (a) $\frac{1}{2}$ (b) $\frac{1}{4}$ (c) all of them (d) none of them	1
	(ii) The recombination frequency is 5% between genes A and B, 20% between B and C, and 25% between A and C. Which pair is most tightly linked? (a) all equally (b) B and C (c) A and B (d) A and C	1
	(iii) In which of the following is the female the heterogametic sex? (a) humans (b) grasshoppers (c) Drosophila (d) birds	1
	(iv) Which of the following is a non-medicated IUD? (a) LNG-20 (b) Lippes loop (c) Multiload 375 (d) CuT	1

	(v) In one year, with no migration, a population of 2000 deer falls to 1500. Its growth rate per individual per year is: (a) –0.25 (b) –500 (c) 0.25 (d) –0.5	1
	(vi) Given below are two statements marked Assertion and Reason. Read both the statements carefully and choose the correct option. **Assertion:** The Ti plasmid of Agrobacterium is "disarmed" before it is used as a cloning vector in plants. **Reason:** The natural Ti plasmid causes plant cells to form tumours. (a) Both Assertion and Reason are true, and Reason is the correct explanation for Assertion. (b) Both Assertion and Reason are true, but Reason is not the correct explanation for Assertion. (c) Assertion is true and Reason is false. (d) Both Assertion and Reason are false.	1
	(vii) Given below are two statements marked Assertion and Reason. Read both the statements carefully and choose the correct option. **Assertion:** Human insulin made by recombinant DNA technology does not cause allergic reactions. **Reason:** E. coli was used as the host to produce the insulin chains. (a) Both Assertion and Reason are true, and Reason is the correct explanation for Assertion. (b) Both Assertion and Reason are true, but Reason is not the correct explanation for Assertion. (c) Assertion is true and Reason is false. (d) Both Assertion and Reason are false.	1
	(viii) The anticodon of a tRNA is 3′–GGA–5′. Write the codon it pairs with, in the 5′ → 3′ direction.	1
	(ix) A plant has 2n = 16. How many chromosomes are present in the generative cell of its pollen grain?	1
	(x) Name the hormone secreted by the ovary in late pregnancy that helps in childbirth.	1
	(xi) What is the fusion of a male gamete with the egg called?	1
	(xii) Who first isolated DNA, calling it "nuclein"?	1
	(xiii) Name the yeast used in the commercial production of ethanol.	1
	(xiv) Name a plant with hallucinogenic properties.	1
	(xv) Expand IUCN.	1
	(xvi) Name the bacterium that fixes nitrogen in the root nodules of leguminous plants.	1

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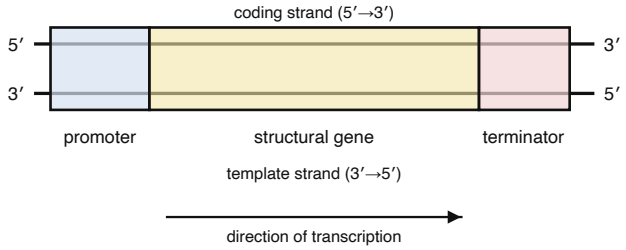
	(xvii) Name the two subunits of a bacterial ribosome.	1
	(xviii) In a test cross of a dihybrid with unlinked genes, what is the ratio of parental to recombinant offspring?	1
	(xix) Which layer around the human ovum prevents the entry of more sperms after fertilisation?	1
	(xx) Name the process in which many copies of a gene of interest are produced in a host cell.	1

Section B (14 marks)

2.	In Drosophila, a dihybrid test cross gave 46% and 44% offspring of the two parental types, and 6% and 4% of the two recombinant types. Calculate the recombination frequency. What does it tell you about the two genes?	2
3.	Why does a tender coconut contain both a liquid and a white solid part? **OR** What is perisperm? Give one example of a seed that has it.	2
4.	What is a probe in DNA hybridisation, and how are the probe-bound fragments detected?	2
5.	Why are antibiotics of no use in treating viral diseases such as the common cold?	2
6.	Why is the pyramid of numbers in a tree ecosystem inverted? **OR** Distinguish between a grazing food chain and a detritus food chain.	2
7.	Explain how the appearance of antibiotic-resistant bacteria illustrates natural selection.	2
8.	What role do methanogens play (a) in the rumen of cattle, (b) in a biogas plant?	2

Section C (21 marks)

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9.	In the diagram of a transcription unit below, identify the template strand and the coding strand. Why is the coding strand so called, even though it is not used for transcription? State the role of the terminator.  **OR** Describe Griffith's experiment with Streptococcus pneumoniae and state his conclusion.	3
10.	What is aneuploidy? Describe the chromosome make-up and two features of (a) Turner's syndrome, (b) Klinefelter's syndrome.	3
11.	Name the three essential tools of recombinant DNA technology and state the role of each.	3
12.	Distinguish between active and passive immunity. Give one natural and one artificial example of each.	3
13.	Write the equation for the population density at time t + 1, and explain the four factors in it.	3
14.	State the role of each in the human menstrual cycle: (a) the Graafian follicle, (b) the corpus luteum, (c) the endometrium. **OR** Describe the structure of a human ovum at the time of ovulation.	3
15.	(a) Name three animals that became extinct in the recent past. (b) Which group of animals has the highest percentage of threatened species according to the IUCN Red List? (c) How is the present rate of extinction different from that of earlier mass extinctions?	3

Section D (15 marks)

16.	(a) State the central dogma of molecular biology. Name the process that is an exception to it. *[2]* (b) A gene produces the mRNA 5′–AUG UUU GGC UAA–3′. (AUG = Met, UUU = UUC = Phe, UUG = Leu, GGC = Gly, GCU = Ala, UAA = stop) What happens to the polypeptide if (i) the fourth base, U, is deleted; (ii) UUU changes to UUC? *[3]*	5

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17.	(a) Describe the structure of a typical anther and the layers of its wall. *[3]* (b) What is meant by saying that an anther is dithecous? *[1]* (c) Pollen of which weed causes allergies in many people in India? *[1]* **OR** (a) How is haemophilia inherited, and what is its main symptom? *[2]* (b) How does thalassemia differ from sickle-cell anaemia? *[2]* (c) What is a Mendelian disorder? *[1]*	5
18.	(a) Give two examples of insects used as biocontrol agents, and what they control. *[2]* (b) State two advantages of organic farming over chemical-based farming. *[2]* (c) How do mycorrhizal fungi such as Glomus help plants? *[1]* **OR** (a) Name three categories of contraceptive methods, with one example of each. *[3]* (b) Up to which stage of pregnancy is medical termination considered relatively safe? Why is it strictly regulated in India? *[2]*	5

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Answers and Marking Scheme

Marks for each step are shown in brackets. Any correct alternative method gets full credit.

Section A (20 marks)

Question 1

(i) **(a)** $\frac{1}{2}$. *Working:* After two generations there are four molecules; the two original strands are in two of them.

(ii) **(c)** A and B. *Working:* The lower the recombination frequency, the closer and more tightly linked the genes.

(iii) **(d)** birds. *Working:* Female birds are ZW and males ZZ.

(iv) **(b)** Lippes loop. *Working:* CuT and Multiload release copper ions; LNG-20 releases a hormone.

(v) **(a)** –0.25. *Working:* (1500 – 2000)/2000.

(vi) **(a)** Both Assertion and Reason are true, and Reason is the correct explanation for Assertion. *Working:* Disarming removes the tumour-causing ability but keeps the ability to transfer DNA.

(vii) **(b)** Both Assertion and Reason are true, but Reason is not the correct explanation for Assertion. *Working:* Both are true, but the absence of allergy is because the product is identical to human insulin, not because of the host used.

(viii) 5′–CCU–3′.

(ix) 8.

(x) Relaxin.

(xi) Syngamy.

(xii) Friedrich Meischer.

(xiii) Saccharomyces cerevisiae.

(xiv) Datura (or Atropa belladonna).

(xv) International Union for Conservation of Nature and Natural Resources.

(xvi) Rhizobium.

(xvii) 50S and 30S (together 70S).

(xviii) 1 : 1.

(xix) The zona pellucida.

(xx) Gene cloning.

Section B (14 marks)

2. Recombination frequency = 6% + 4% = 10% (1). The genes are linked on the same chromosome, about 10 map units apart (1).

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3. The coconut endosperm is first free-nuclear: thousands of free nuclei in a liquid form the coconut water (1). Later cell walls form at the edges, giving the cellular endosperm, the white kernel (1).

OR The remains of the nucellus that persist in a seed (1). Black pepper or beet (1).

4. A short single-stranded DNA or RNA labelled with radioactivity or a fluorescent dye, complementary to the sequence being sought (1). After hybridisation, the bound probe is detected by autoradiography (for a radioactive label) or fluorescence (1).

5. Antibiotics act on structures and processes found only in bacteria, such as the cell wall and bacterial ribosomes (1). Viruses have none of these; they multiply inside host cells using the host's machinery (1).

6. A single tree (the producer) supports a large number of herbivorous insects, which support fewer birds (1). So the number of individuals at the base is smaller than at the next level (1).

OR A grazing food chain begins with living green plants eaten by herbivores (1). A detritus food chain begins with dead organic matter, broken down by decomposers such as bacteria and fungi (1).

7. In a bacterial population, a few cells happen to have mutations that make them resistant (1). When the antibiotic is used, the others die while the resistant ones survive and multiply, so resistant bacteria soon make up the population (1).

8. (a) They break down cellulose in the rumen, helping cattle digest it, and release methane (1). (b) Methanogens such as Methanobacterium produce methane-rich biogas from cattle dung (1).

Section C (21 marks)

9. The template strand runs 3′ → 5′ (in the direction of transcription); the other strand, 5′ → 3′, is the coding strand (1). Its sequence is the same as that of the RNA, except that it has thymine in place of uracil (1). The terminator, at the 3′ end of the coding strand, marks where transcription ends (1).

OR Mice injected with live S (smooth, capsulated) bacteria died, while those given R (rough) bacteria or heat-killed S bacteria lived (1). Mice given a mixture of heat-killed S and live R bacteria died, and live S bacteria were recovered from them (1). Griffith concluded that some "transforming principle" from the dead S bacteria had changed the R bacteria into the virulent S form (1).

10. Gain or loss of one or a few chromosomes, due to failure of chromatids to separate (1). (a) 45 chromosomes, XO: females with rudimentary ovaries, lacking secondary sexual characters (1). (b) 47 chromosomes, XXY: males with overall masculine development but feminine features such as development of breasts (gynaecomastia); sterile (1).

11. Restriction enzymes cut DNA at specific sites (1). Cloning vectors carry the gene into the host and allow it to be copied and selected (1). A competent host takes up the recombinant DNA and multiplies it (1).

12. Active immunity: the body makes its own antibodies after meeting an antigen; it is slow but long-lasting (1). Natural: recovering from an infection; artificial: vaccination (1). Passive immunity:

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ready-made antibodies are given; it is quick but temporary. Natural: IgG from mother to foetus or IgA in colostrum; artificial: injection of anti-tetanus serum or snake antivenom (1).

13. $N_{t+1} = N_t + [(B + I) – (D + E)]$ (1). Natality (B), births, and immigration (I), individuals coming in from elsewhere, increase the population (1). Mortality (D), deaths, and emigration (E), individuals leaving, decrease it (1).

14. (a) It secretes oestrogens and releases the ovum at ovulation (1). (b) It secretes large amounts of progesterone, which maintains the endometrium (1). (c) It thickens to receive an embryo; if fertilisation does not occur it breaks down and is shed in menstruation (1).

OR The ovum is a secondary oocyte, arrested in meiosis II (1). It is surrounded by a non-cellular layer, the zona pellucida (1), and outside it by follicle cells, the corona radiata (1).

15. (a) Any three: the dodo, the quagga, the thylacine, Steller's sea cow, the Bali, Javan and Caspian tigers (1). (b) Amphibians (about 32%) (1). (c) It is estimated to be 100 to 1000 times faster, and it is caused by human activities (1).

Section D (15 marks)

16. (a) Genetic information flows from DNA to RNA to protein (1). In some viruses, information flows from RNA to DNA: reverse transcription (1). (b) The normal product is Met–Phe–Gly (½). (i) The reading frame shifts: AUG UUG GCU AA…, giving Met–Leu–Ala and further changes: a frameshift mutation (1½). (ii) No change, because both codons code for Phe: the code is degenerate (1).

17. (a) The anther is bilobed, each lobe having two microsporangia, four in all (1). The wall has the epidermis, endothecium, middle layers and the innermost tapetum, which nourishes the developing pollen (1). The centre of each microsporangium has sporogenous tissue, which forms the microspores (1). (b) It has two lobes (thecae) (1). (c) Parthenium (carrot grass) (1).

OR (a) It is X-linked recessive, passed from carrier mothers to sons; females are rarely affected (1). A protein of the blood-clotting chain is affected, so even a small cut may bleed without stopping (1). (b) Thalassemia is a quantitative problem: too few globin chains are made (1). Sickle-cell anaemia is a qualitative problem: an abnormal globin is made (1). (c) A disorder caused by an alteration or mutation in a single gene, inherited according to Mendel's principles (1).

18. (a) Ladybird beetles control aphids (1); dragonflies control mosquitoes (1). (b) It does not leave toxic chemicals in soil, water and food, and it keeps useful organisms such as predators and pollinators alive (2). (c) They absorb phosphorus from the soil and pass it to the plant (they also give resistance to root pathogens and tolerance to drought) (1).

OR (a) Any three: natural (periodic abstinence, coitus interruptus, lactational amenorrhoea); barrier (condoms, diaphragms, cervical caps); IUDs (CuT, Multiload 375); oral pills (Saheli); injectables and implants; surgical methods (vasectomy, tubectomy) (3). (b) During the first trimester, up to 12 weeks (1). To prevent its misuse, especially for female foeticide (1).

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